

DISPERSION, ELECTROPHOTOGRAPHIC PHOTORECEPTOR,
ELECTROPHOTOGRAPHIC PROCESS, ELECTROPHOTOGRAPHIC DEVICE, AND
PROCESS CARTRIDGE FOR ELECTROPHOTOGRAPHIC DEVICE
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Sochiyo Purosesu Katorijji]

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[Title] Dispersion, Electrophotographic Photoreceptor, /1¹
Electrophotographic Process, Electrophotographic
Device, and Process Cartridge for Electrophotographic
Device

[Abstract]

[Problem] To provide a dispersion permitting the manufacturing of an electrophotographic photoreceptor with long-term stability in which high sensitivity is not lost, electrostatic properties do not decrease, and residual potential does not increase even with repeated use, and an electrophotographic photoreceptor having improved abrasion resistance in addition to the above-stated characteristics.

[Solution] A dispersion comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å), characterized by comprising polyvinyl acetyl at an acetylation rate of not less than 4 molar percent.

[Claims] /2

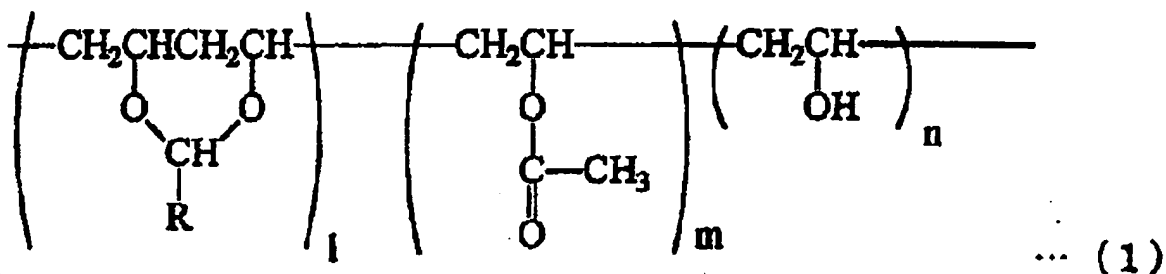
[Claim 1] A dispersion comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) characterized by comprising polyvinyl acetal at an acetylation rate of not less than 4 molar percent.

[Claim 2] The dispersion of claim 1 further characterized in that

¹Numbers in the margin indicate pagination in the foreign text.

said polyvinyl acetal is denoted by general formula (1) below:

[Chem. 1]



wherein R denotes an alkyl group with 1-5 carbon atoms and l, m, and n denote composition ratios.

[Claim 3] The dispersion of claim 2 further characterized in that in said polyvinyl acetal of said general formula (1), R denotes only a propyl group.

[Claim 4] The dispersion of claim 1 further characterized in that the weight average molecular weight of said polyvinyl acetal is not less than 100,000.

[Claim 5] The coating solution [sic] described in any of claims 1-4 characterized in that a solvent contained in said coating solution comprises at least one member selected from among ketone-based solvents, ester-based solvents, and ether-based solvents.

[Claim 6] An electrophotographic photoreceptor comprising at least a photosensitive layer on an electrically conductive support with said photosensitive layer comprising titanyl

phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å), characterized in that said photosensitive layer comprises polyvinyl acetal at an acetylation rate of not less than 4 molar percent.

[Claim 7] The electrophotographic receptor of claim 6 further characterized in that said polyvinyl acetal is denoted by said general formula (1) wherein R denotes only a propyl group.

[Claim 8] The electrophotographic receptor of claim 6 or 7 further characterized in that the weight average molecular weight of said polyvinyl acetal is not less than 100,000.

[Claim 9] The electrophotographic receptor of any of claims 6-8 further characterized in that said photosensitive layer is of a multilayer configuration comprising a charge-generating layer and a charge-transporting layer.

[Claim 10] The electrophotographic receptor of claim 9 further characterized in that said charge-transporting layer of said electrophotographic receptor comprises at least polycarbonate with a triarylamine structure as principal chain and/or a side chain.

[Claim 11] An electrophotographic process of repeatedly conducting at least charging, image exposure, developing, transferring, cleaning, and discharging of an electrophotographic photoreceptor, characterized in that on an electrically conductive support is provided a photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at 27.2

$\pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent.

[Claim 12] An electrophotographic device provided with at least a charging means, an image exposure means, a development means, a transfer means, a cleaning means, a discharging means, and an electrophotographic receptor, characterized in that said electrophotographic receptor comprises a photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent on an electrically conductive support.

[Claim 13] A process cartridge for an electrophotographic device provided with at least an electrophotographic photoreceptor, characterized in that said electrophotographic receptor comprises a photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent on an electrically conductive support.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a dispersion comprising phthalocyanine having a specified X-ray diffraction spectrum, an electrophotographic receptor

employing this dispersion, and an electrophotographic process, electrophotographic device, and process cartridge for an electrophotographic device employing the same. More particularly, the present invention relates to an electrophotographic photoreceptor with good charge potential in the photoreceptor and good residual potential stability even with repeated use, and an electrophotographic process, electrophotographic device, and process cartridge for an electrophotographic device employing the same.

[0002]

[Prior Art] Information processing systems employing electrophotographic systems have undergone amazing developments in recent years. In particular, optical printers recording information with light by converting information into digital signals have exhibited marked improvement in print quality and reliability. This digital recording technology has been developed not only for printers, but also for digital copiers that are employed in ordinary copiers. Further, demand for 1/3 copiers consisting of this digital recording technology applied to conventional analog copiers is expected to increase steadily in the future due to the addition of various information processing functions.

[0003] Compact, inexpensive, and highly reliable semiconductor lasers (LD) and light-emitting diodes (LED) are currently often employed as light sources for optical printers. The emission wavelength of currently employed LEDs is 660 nm and the emission

wavelength range of LDs is in the near infrared range. Thus, there is a need for the development of electrophotographic photoreceptors with high sensitivity from the visible light range to the near infrared range.

[0004] The light sensitivity wavelength range of electrophotographic photoreceptors ends up being for the most part determined by the light sensitivity range of the charge-generating substances employed in the photoreceptors. For this reason, numerous charge-generating substances such as various azo dyes, polycyclic quinone pigments, trigonal selenium, and various phthalocyanine pigments have been developed thus far. Of these, titanyl phthalocyanine (abbreviated as TiOPc) is highly important and useful as a photoreceptive material for use in electrophotographic printers and digital copiers employing light sources in the form of LEDs and LDs because it exhibits high sensitivity to light with a wavelength in the 600-800 nm range.

[0005] Good electrostatic characteristics such as sensitivity, receptive potential, an ability to hold a potential, potential stability, residual potential, and spectral characteristics are required of electrophotographic photoreceptors employed repeatedly in the Carlson process and similar processes. In particular, a drop in chargeability and an increase in residual potential due to repeated use in highly sensitive photoreceptors is known through experience to control the service lifetime characteristics of many photoreceptors. Titanyl phthalocyanine is no exception. Accordingly, the stability with repeated use of

photosensitive photoreceptors employing titanyl phthalocyanine is still inadequate and there is a great need for perfection of this technology. Further, there is a need for a dispersion that can be used to manufacture photoreceptors with these characteristics with long-term stability.

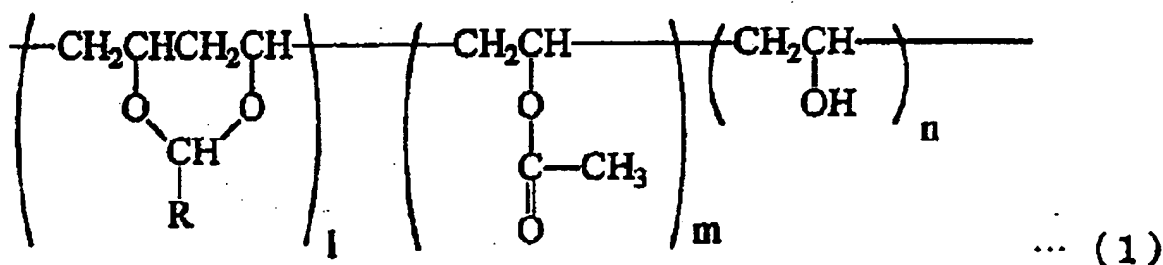
[0006]

[Problems to Be Solved by the Invention] The object of the present invention is to provide a stable electrophotographic photoreceptor in which high sensitivity is not lost, chargeability does not decrease, and residual potential does not increase even with repeated use. A further object is to provide a dispersion that can be used to manufacture a photoreceptor having the above-stated characteristics with long-term stability. A still further object of the present invention is to provide an electrophotographic photoreceptor with improved abrasion resistance while retaining the above-stated characteristics. A still further object of the present invention is to provide a stable electrophotographic process in which high sensitivity is not lost, chargeability does not decrease, and an increase in residual potential does not occur even with repeated use. A still further object of the present invention is to provide a stable electrophotographic device in which high sensitivity is not lost, chargeability does not decrease, and an increase in residual potential does not occur even with repeated use, and a process cartridge for the same.

[0007]

[Means of Solving the Problems] The present invention provides:
 (1) a dispersion comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) characterized by comprising polyvinyl acetal at an acetylation rate of not less than 4 molar percent; (2) the dispersion of (1) further characterized in that said polyvinyl acetal is denoted by general formula (1) below:

[Chem. 1]



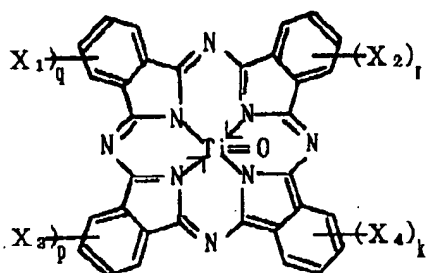
wherein R denotes an alkyl group with 1-5 carbon atoms and l, m, and n denote composition ratios; (3) the dispersion of (2) further characterized in that in said polyvinyl acetal of said general formula (1), R denotes only a propyl group; (4) the dispersion of (1) further characterized in that the weight average molecular weight of said polyvinyl acetal is not less than 100,000; (5) the coating solution [sic] described in any of (1)-(4) characterized in that a solvent contained in said coating solution comprises at least one member selected from among

ketone-based solvents, ester-based solvents, and ether-based solvents; (6) an electrophotographic photoreceptor comprising at least a photosensitive layer on an electrically conductive support with said photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å), characterized in that said photosensitive layer comprises polyvinyl acetal at an acetylation rate of not less than 4 molar percent; (7) the electrophotographic receptor of (6) further characterized in that said polyvinyl acetal is denoted by said general formula (1) wherein R denotes a propyl group; (8) the electrophotographic receptor of (6) or (7) further characterized in that the weight average molecular weight of said polyvinyl acetal is not less than 100,000; (9) the electrophotographic receptor of any of (6)-(8) further characterized in that said photosensitive layer is of a multilayer configuration comprising a charge-generating layer and a charge transporting layer; (10) the electrophotographic receptor of (9) further characterized in that said charge /4 transporting layer of said electrophotographic receptor comprises at least polycarbonate having a triarylamine structure as principal chain and/or a side chain; (11) an electrophotographic process of repeatedly conducting at least charging, image exposure, developing, transferring, cleaning, and discharging of an electrophotographic photoreceptor, characterized in that on an electrically conductive support is provided a photosensitive

layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent; (12) an electrophotographic device provided with at least a charging means, an image exposure means, a development means, a transfer means, a cleaning means, a discharging means, and an electrophotographic receptor, characterized in that said electrophotographic receptor comprises a photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent on an electrically conductive support; and (13) a process cartridge for an electrophotographic device provided with at least an electrophotographic photoreceptor, characterized in that said electrophotographic receptor comprises a photosensitive layer comprising titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays (wavelength 1.514 Å) and polyvinyl acetal at an acetylation rate of not less than 4 molar percent on an electrically conductive support.

[0008] The basic structure of the titanyl phthalocyanine pigment employed in the present invention is denoted by general formula (2) below.

[Chem. 3]



..... (2)

(wherein X_1 , X_2 , X_3 , and X_4 each independently denote various halogen atoms and p , q , r , and k each independently denote a number from 0 to 4).

[0009] Examples of references relating to methods of synthesizing TiOPc and the electrophotographic characteristics thereof are Patent Application Publication Nos. Sho 57-148745, Sho 59-36254, Sho 59-44054, Sho 59-31965, Sho 61-239248, and Sho 62-67094.

Various crystal systems of TiOPc are known. TiOPc of various different crystal configurations are disclosed in Patent Application Publication Nos. Sho 59-49544, Sho 59-41616959, Sho 61-239248, Sho 62-67094, Sho 63-366, Sho 63-116158, Sho 196067, Sho 64-17066, and the like. The present inventors focused on binder resins that are incorporated into charge-generating layers and conducted extensive research into the electrostatic characteristics, dispersion properties, and storage properties following repeated use of the photoreceptors to solve the above-stated problems; the present invention was devised on that basis.

[0010] Examples of methods yielding the targeted crystal

configuration (titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ for CuK α characteristic X rays) are: methods based on known synthesis processes; methods changing the crystals during cleaning and refining processes; and particularly, methods comprising crystal conversion processes. Examples of methods comprising crystal conversion processes are common conversion methods based on solvents or mechanical loads, and sulfuric acid pasting methods in which titanyl phthalocyanine is dissolved in sulfuric acid, water is poured into the solution to obtain fixed crystals, and the fixed crystals are subjected to the above-described conversion.

[0011] As set forth above, with repeated use by the Carlson process or a similar process, even photoreceptors employing highly sensitive TiOPc undergo decreased chargeability and increased residual potential, thus determining the service life of the photoreceptor. The present inventors focused on the crystal configuration of TiOPc and conducted research into electrostatic properties after repeated use of photoreceptors to solve this problem. As a result, they confirmed that when a dispersion comprising the above-stated specific binder resin was employed, a photoreceptor with good repeat characteristics for the above-stated physical properties was obtained; the present invention was devised on that basis.

[0012] The present invention will be described with drawings. Fig. 1 is a cross-sectional view of the electrophotographic

photoreceptor employed in the present invention in which a single photosensitive layer 33 with chief components in the form of a charge-generating layer and a charge-transporting layer is provided on an electrically conductive support 31.

[0013] Figs. 2 and 3 are cross-sectional views of other examples of the configuration of the electrophotographic photoreceptor employed in the present invention. The layered configuration comprises a charge-generating layer 35 the chief component of which is a charge-generating material, and a charge-transporting layer 37 the chief component of which is a charge-transporting material.

[0014] Electrically conductive support 31 comprises a substance exhibiting electrical conductivity in the form of a volume resistivity of not more than 10^{10} Ωcm , such as a metal such as aluminum, nickel, chromium, nickel, copper, gold, silver, or platinum, or a metal oxide such as tin oxide or indium oxide, that is coated onto a film or disk of plastic or paper by vapor deposition or sputtering. Alternatively, a sheet of aluminum, aluminum alloy, nickel, stainless steel, or the like, or a 5 tube of one of these materials that has been shaped into a roughly tubular form by extrusion, drawing, or some other method, cut, superfinished, and subjected to polishing or some other surface treatment may be employed. Further, the endless nickel belt or endless stainless steel belt disclosed in Patent Application Publication No. Sho 52-36016 may also be employed as electrically conductive support 31.

[0015] Additionally, an electrically conductive powder can be dispersed in a suitable binder resin and coated on one of the above-described supports for use as electrically conductive support 31 of the present invention. Examples of such electrically conductive powders are carbon black; acetylene black; metal powders such as aluminum, nickel, iron, copper zinc, and silver; and metal oxide powders such as electrically conductive tin oxide and ITO. Polystyrene, styrene-acrylonitrile copolymer, styrene-butadiene copolymer, styrene-anhydrous maleic acid copolymer, polyester, polyvinyl chloride, vinyl chloride-vinyl acetate copolymer, polyvinyl acetate, polyvinylidene chloride, polyallylate resin, phenoxy resin, polycarbonate, acetic cellulose resin, ethyl cellulose resin, polyvinyl butyral, polyvinyl formal, polyvinyl toluene, poly-N-vinylcarbazole, acrylic resin, silicone resin, epoxy resin, melamine resin, urethane resin, phenol resin, alkyd resin, and other thermoplastic resins, thermosetting resins, and photosetting resins may simultaneously be employed as the binder resin. Such an electrically conductive layer can be provided by dispersing these photosensitive powders and binder resins in a suitable solvent such as tetrahydrofuran, dicyclomethane, methyl ethyl ketone, or toluene and applying the dispersion.

[0016] Further, an electrically conductive layer can be provided by applying a heat shrink tube incorporating one of said electrically conductive powders in a base material such as polyvinyl chloride, polypropylene, polyester, polystyrene,

polyvinylidene chloride, polyethylene, chlorinated rubber, or Teflon on a suitable cylindrical substrate, and the combination then employed to advantage as electrically conductive support 31 of the present invention.

[0017] The photosensitive layer will be described next. The photosensitive layer may consist of a single or multiple layers, but to facilitate description, the case where this layer is configured of a charge-generating layer 35 and a charge-transporting layer 37 will be described first.

[0018] Charge-generating layer 35 is a layer the chief component of which is a charge-generating material in the form of TiOPc exhibiting a prescribed X-ray diffraction spectrum (titanyl phthalocyanine having a maximum diffraction peak at $27.2 \pm 0.2^\circ$ at a Bragg angle of 2θ).

[0019] Charge-generating layer 35 is formed by dispersing the TiOPc with a binder resin as needed in a suitable solvent using a ball mill, attriter, sand mill, ultrasound, or the like; coating this dispersion on an electrically conductive support; and drying the coating.

[0020] The polyvinyl acetal with a degree of acetylation of not less than 4 molar percent, preferably, about 4-10 molar percent, shown in Formula (1) may be employed to advantage as the resin in charge-generating layer 35 as needed. Further, substituent R in Formula (1) denotes an alkyl group with 1-5 carbon atoms, and may be used to particular advantage when denoting only a propyl group. Further, a polyvinyl acetal with a weight average

molecular weight of not less than 100,000 is used to particular advantage. The binder resin is suitably employed in a proportion of 0-500 weight parts, preferably 10-300 weight parts, per 100 weight parts of charge-generating substance.

[0021] In addition to TiOPc having the specific above-described X-ray diffraction spectrum, it is also possible to employ other charge-generating materials in combination in charge-generating layer 35. Representative examples thereof are: monoazo dyes, diazo dyes, triazo dyes, perylene pigments, berinon pigments, quinacrylidone pigments, quinone-based condensed polycyclic compounds, squallic acid-based dyes, other phthalocyanine pigments, naphthocyanine pigments, and azulenium salt-based dyes.

[0022] Examples of the solvents employed are: isopropanol, acetone, methyl ethyl ketone, cyclohexanone, tetrahydrofuran, dioxane, ethyl cellosolve, ethyl acetate, methyl acetate, dichloromethane, dichloroethane, monochlorobenzene, cyclohexanone, toluene, xylene, and ligroin. Ketone-based solvents, ester-based solvents, and ether-based solvents are employed to particular advantage. Methods of applying the coating solution that are suitable for use include coating by immersion, spray coating, bead coating, nozzle coating, spinner coating, and ring coating. Charge-generating layer 35 is suitably 0.01-5 μm , preferably 0.1-2 μm , in thickness.

[0023] Charge-transporting layer 37 can be formed by dissolving or dispersing a charge-transporting material and a binder resin in a suitable solvent, applying the solution or dispersion over

the charge-generating layer, and drying it. As needed, plasticizers, leveling agents, antioxidants, and the like may be added.

[0024] Charge-transporting materials are divided into hole-transporting materials and electron-transporting materials. Examples of charge-transporting materials in the form of electron-receiving materials are chloranil, bromoanil, tetracyanoethylene, tetracyanoquinodimethane, 2,4,7-trinitro-9-fluoronene, 2,4,5,7-tetarnitro-9-fluorenone, 2,4,5,7-tetranitroxanthone, 2,4,8-trinitrothioxanthone, 2,6,8-trinitro-4H-indeno[1,2-b]thiophene-4-one, 1,3,7-trinitrodibenzothiophene-5,5-dioxide, and benzoquinone derivatives.

[0025] Examples of hole-transporting materials are poly-N-vinylcarbazole and derivatives thereof, poly-γ-carbazolyl ethylglutamate and derivatives thereof, pyrene-formaldehyde condensates and derivatives thereof, polyvinyl pyrene, 46 polyvinyl phenanth[r]olene, polysilane, oxazole derivatives, oxadiazole derivatives, imidazole derivatives, monoarylamine derivatives, diarylamine derivatives, triarylamine derivatives, stilbene derivatives, α-phenylstilbene derivatives, benzidine derivatives, diarylmethane derivatives, triarylmethane derivatives, 9-styryl anthracene derivatives, pyrazoline derivatives, divinylbenzene derivatives, hydrazone derivatives, indene derivatives, butadiene derivatives, pyrene derivatives, bisstilbene derivatives, and enamine derivatives. These charge-transporting substance may be employed singly or in mixtures of

two or more.

[0026] Examples of binder resins are polystyrene, styrene-acrylonitrile copolymer, styrene-butadiene copolymer, styrene-maleic anhydride copolymer, polyester, polyvinyl chloride, vinyl chloride-vinyl acetate copolymer, polyvinyl acetate, polyvinylidene chloride, polyallates, phenoxy resin, polycarbonates, cellulose acetate resins, polyvinyl butyral, polyvinyl formal, polyvinyl toluene, poly-N-vinylcarbazole, acrylic resin, silicone resin, epoxy resin, melamine resin, urethane resin, phenol resin, alkyd resin, and other thermoplastic and thermosetting resins.

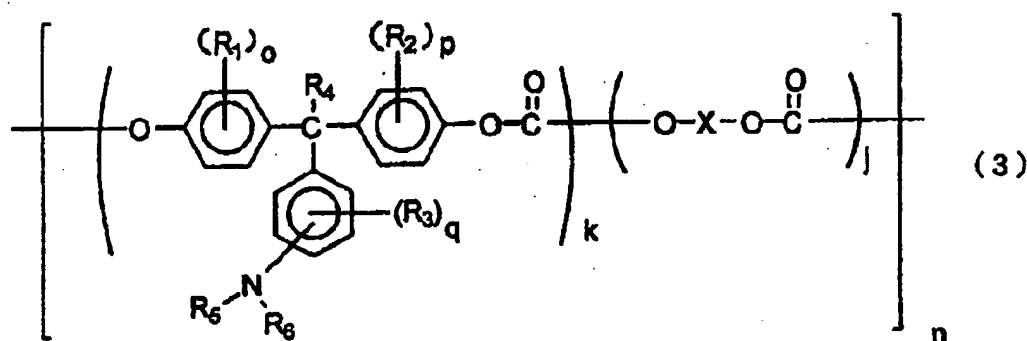
[0027] The charge-transporting substance is suitably employed in a proportion of 20-300 weight parts, preferably 40-150 weight parts, per 100 weight parts of binder resin. The film thickness of the charge-transporting layer is desirably about 5-100 μm . Examples of solvents suitable for use here are: tetrahydrofuran, dioxane, toluene, dichloromethane, monochlorobenzene, dichloroethane, cyclohexanone, methyl ethyl ketone, and acetone.

[0028] Further, macromolecular charge-transporting substances functioning as charge-transporting substances and binder resins are also employed to advantage in the charge-transporting layer. Charge-transporting layers comprised of these macromolecular charge-transporting substances have good resistance to abrasion. Known materials may be employed as macromolecular charge-transporting substances; however, polycarbonates comprising a triarylamine structure in the principal chain and/or a side chain

are employed to advantage. Of these, the macromolecular charge-transporting substances denoted by formulas (3)-(12) are employed to advantage; specific examples of these are given below:

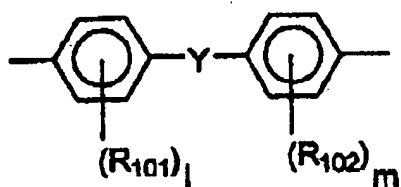
[0029]

[Chem. 4]



(In the formula, R_1 , R_2 , and R_3 each independently denote a substituted or unsubstituted alkyl group or a hydrogen atom; R_4 denotes a hydrogen atom or a substituted or unsubstituted alkyl group; R_5 and R_6 denotes substituted or unsubstituted aryl groups; o , p , and q each separately denote an integer of from 0-4; k and j denote a composition where $0.1 \leq k \leq 1$ and $0 \leq j \leq 0.9$; and n denotes a number of repeating units in the form of an integer from 5-5,000. X denotes an aliphatic bivalent group, cycloaliphatic bivalent group, or the bivalent group denoted by the general formula below:

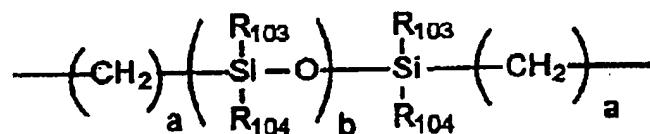
[Chem. 5]



where R₁₀₁ and R₁₀₂ each independently denote a substituted or unsubstituted alkyl group or aryl group, or a halogen atom; 1 and m are integers of from 0-4; Y denotes a single bond, straight-chain, branched chain, or cyclic alkylene group with 1-12 carbon atoms, -O-, -S-, -SO-, -SO₂-, -CO-, -CO-O-Z-O-CO- (where Z denotes an aliphatic bivalent group), or

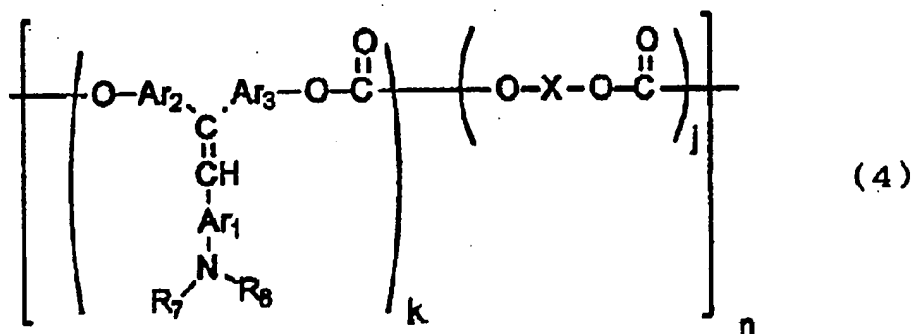
[Chem. 6]

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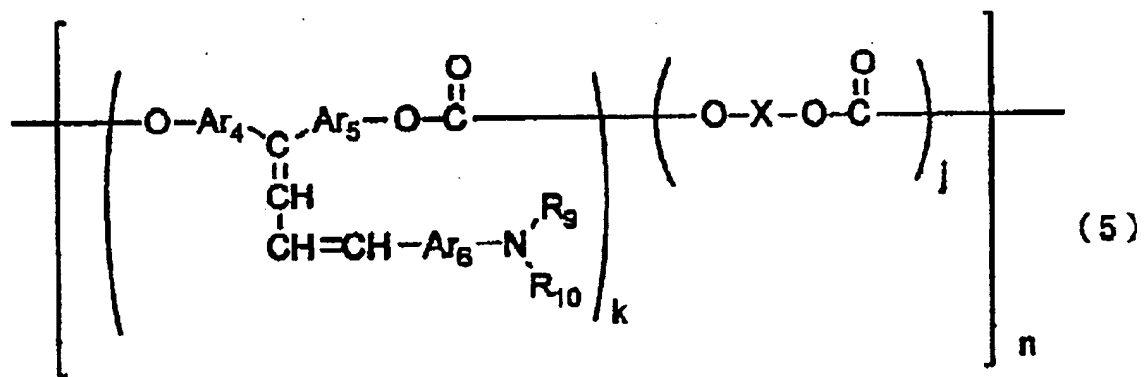
where a denotes an integer of from 1-20, b denotes an integer of from 1-2,000, R₁₀₃ and R₁₀₄ denote substituted or unsubstituted alkyl groups or aryl groups. Here, R₁₀₁ and R₁₀₂, and R₁₀₃ and R₁₀₄, may be identical or different.)

[Chem. 7]



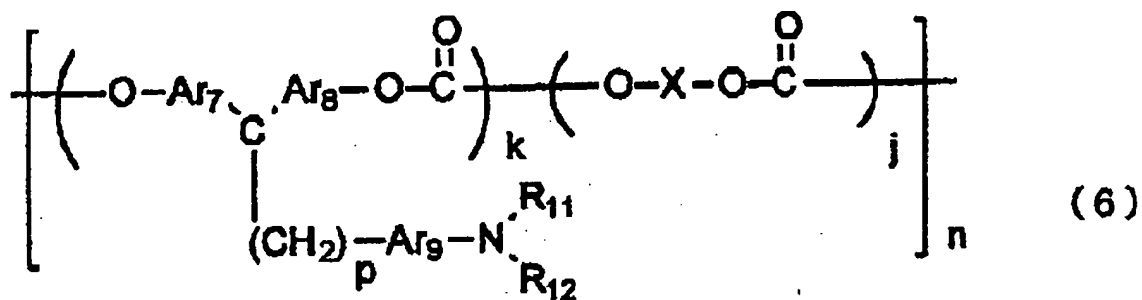
(In the formula, R_7 and R_8 denote substituted or unsubstituted aryl groups; Ar_1 , Ar_2 , and Ar_3 denote identical or different allylene groups. X , k , j , and n are defined as in Formula (3).)

[Chem. 8]



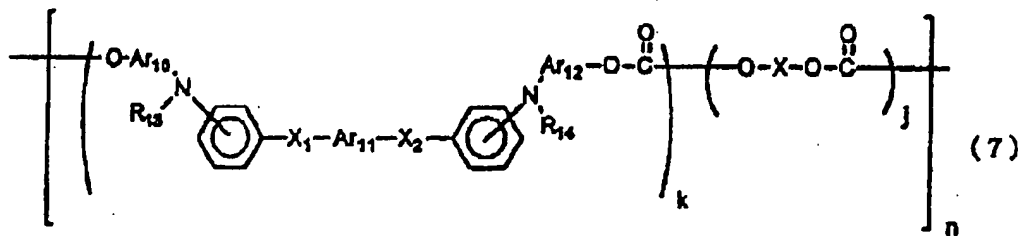
(In the formula, R_9 and R_{10} denote substituted or unsubstituted aryl groups and Ar_4 , Ar_5 , and Ar_6 denote identical or different allylene groups. X , k , j , and n are defined as in Formula (3).)

[Chem. 9]



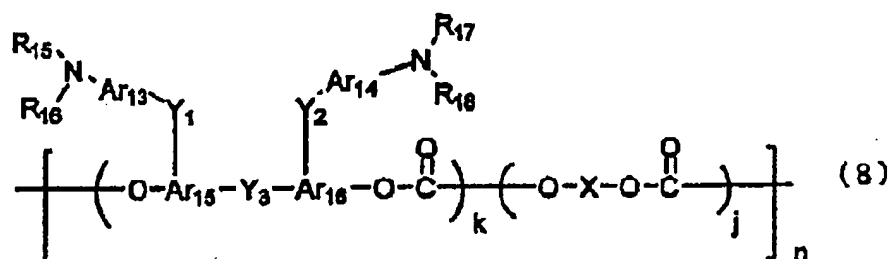
(In the formula, R_{11} and R_{12} denote substituted or unsubstituted aryl groups; Ar_7 , Ar_8 , and Ar_9 denote identical or different allylene groups; and p denotes an integer of from 1-5. X , k , j , and n are defined as in Formula (3).)

[Chem. 10]



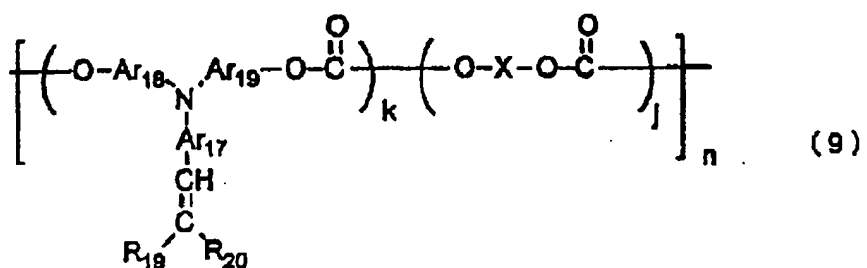
(In the formula, R_{13} and R_{14} denote substituted or unsubstituted aryl groups; Ar_{10} , Ar_{11} , and Ar_{12} denote identical or different allylene groups; and X_1 and X_2 denote substituted or unsubstituted ethylene groups or substituted or unsubstituted vinylene groups. X , k , j , and n are defined as in Formula (3).)

[Chem. 11]



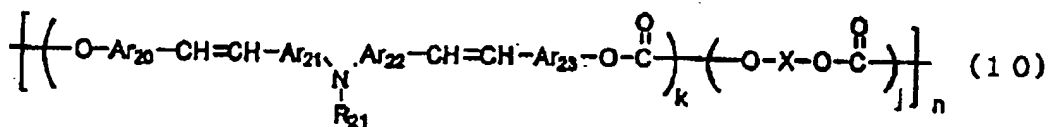
(In the formula, R_{15} , R_{16} , R_{17} , and R_{18} denote substituted or unsubstituted aryl groups; Ar_{13} , Ar_{14} , Ar_{15} , and Ar_{16} denote identical or different allylene groups; and Y_1 , Y_2 , and Y_3 , which may be identical or different, denote single bonds, substituted or unsubstituted alkylene groups, substituted or unsubstituted cycloalkylene groups, substituted or unsubstituted alkylene ether groups, oxygen atoms, sulfur atoms vinylene groups. X , k , j , and n are defined as in Formula (3).)

[Chem. 12]



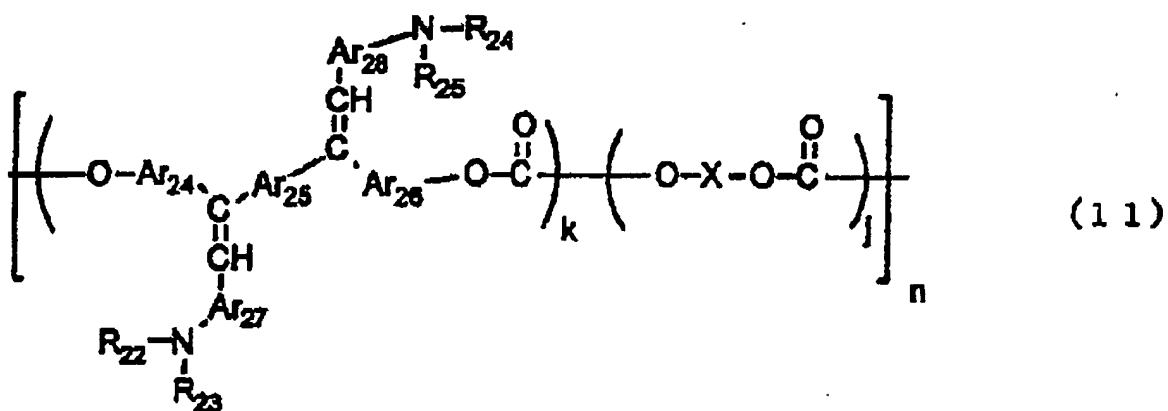
(In the formula, R₁₉ and R₂₀ denotes hydrogen atoms or substituted or unsubstituted aryl groups; R₁₉ and R₂₀ may also form a ring. Ar₁₇, Ar₁₈, and Ar₁₉, denote identical or different allylene groups. X, k, j, and n are defined as in Formula (3).)

[Chem. 13]



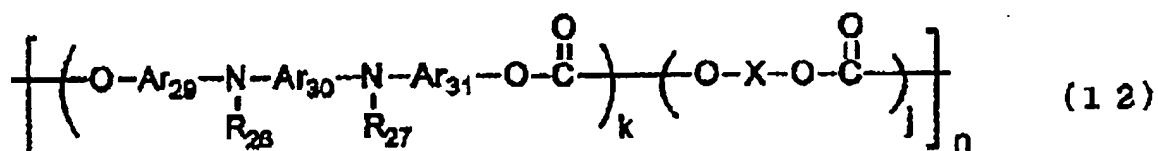
(In the formula, R₂₁ and R₂₂ denote substituted or unsubstituted aryl groups and Ar₂₀, Ar₂₁, Ar₂₂, and Ar₂₃ denote identical or different allylene groups. X, k, j, and n are defined as in Formula (3).)

[Chem. 14]



(In the formula, R_{22} , R_{23} , R_{24} , and R_{25} denote substituted or unsubstituted aryl groups and Ar_{24} , Ar_{25} , Ar_{26} , Ar_{27} , and Ar_{28} denote identical or different allylene groups. X , k , j , and n are defined as in Formula (3).)

[Chem. 15]



(In the formula, R_{26} and R_{27} denote substituted or unsubstituted aryl groups, and Ar_{29} , Ar_{30} , and Ar_{31} denote identical or different allylene groups. X , k , j , and n are defined as in Formula (3).)

[0030] A plasticizer or a leveling agent may be added to charge-

transporting layer 37 in the present invention. Examples of /9 plasticizers that are suitable for use as is are: dibutyl phthalate, dioctyl phthalate, and other commonly employed resin plasticizers. The quantity employed is suitably about 0-30 weight percent of the binder resin. Leveling agents suitable for use are dimethyl silicone oil, methyl phenyl silicone oil, and other silicone oils; polymers having a perfluoroalkyl group in a side chain; and oligomers. The quantity employed is suitable 0-1 weight percent of the binder resin.

[0031] The single layer configuration 33 of the photosensitive layer will be described next. A photoreceptor comprising TiOPc imparting the above-described specific X-ray diffraction spectrum that is dispersed in a binder resin can be employed. The single layer photosensitive layer is formed by dissolving or dispersing a charge-generating substance, charge-transporting substance, and binder resin in a suitable solvent and then coating and drying the solution or dispersion. Functionally separated types of photosensitive layers in which the above-described charge-transporting materials have been added may also be employed to advantage. As needed, plasticizers, leveling agents, antioxidants, and the like may also be added.

[0032] The polyvinyl acetal denoted by General Formula (1) above, the binder resins previously given as examples for charge-transporting layer 37, and the binder resins given as examples for charge-generating layer 35 may be mixed for use as the binder resin. The previously given examples of macromolecular charge-

transporting substances may also be employed. The charge-generating substance is preferably employed in a proportion of 5-40 weight parts, and the charge-transporting substance is preferably employed in a proportion of 0-190 weight parts, more preferably 50-150 weight parts, per 100 weight parts of binder resin. The single photosensitive layer is formed by using a disperser to disperse the charge-generating substance and resin along with a charge-transporting substance, if needed, in a solvent such as tetrahydrofuran, dioxane, dichloroethane, or dihexane using a disperser to obtain a coating solution; and applying the coating solution by immersion coating, spray coating, bead coating, or the like. The film thickness of the single photosensitive layer is suitably about 5-100 μm .

[0033] An undercoating can be provided between electrically conductive support 31 and the photosensitive layer in the electrophotographic photoreceptor of the present invention. The undercoating is generally chiefly comprised of a resin.

Considering that the photosensitive layer is to be coated over this resin using a solvent, a resin with high resistance to most organic solvents is desirably employed. Examples of such resins are polyvinyl alcohol, casein, sodium polyacrylate, and other water-soluble resins, copolymerizing nylon, methoxymethylated nylon, and other alcohol-soluble resins, polyurethane, melamine resin, phenol resin, alkyd-melamine resin, epoxy resin, and resins curing into a three-dimensional meshlike structure. Micropowder pigments of titanium oxide, silica, alumina,

zirconium oxide, tin oxide, indium oxide, and other metal oxides may be added to the undercoating to prevent moiré, reduction in residual potential, and the like.

[0034] The undercoating layer may be formed using suitable solvents and coating methods such as those described above for the photosensitive layer. A silane coupling agent, titanium coupling agent, chromium coupling agent, or the like may be employed as the undercoating in the present invention. Further, an underlayer that has been anodized with Al_2O_3 or provided with an organic substance such as polyparaxylylene (polylene) or an inorganic substance such as SiO_2 , SnO_2 , TiO_2 , ITO, or CeO_2 by vacuum thin-layer formation may be employed to advantage. Known undercoating layers may also be employed. The undercoating layer is suitably 0-5 μm in thickness.

[0035] To protect the photosensitive layer, a protective layer is sometimes provided over the photosensitive layer in the electrophotographic photoreceptor of the present invention. Materials suitable for use in the protective layer are ABS resin, ACS resin, olefin-vinyl monomer copolymer, chlorinated polyether, allyl resin, phenol resin, polyacetal, polyamide, polyamidoimide, polyacrylate, polyallylsulfone, polybutylene, polybutylene terephthalate, polycarbonate, polyethersulfone, polyethylene, polyethylene terephthalate, polyimide, acrylic resin, polymethylpentene, polypropylene, polyphenylene oxide, polysulfone, polystyrene, AS resin, butadiene-styrene copolymer, polyurethane, polyvinyl chloride, polyvinylidene chloride, epoxy

resin, and the like. Additionally, fluororesins such as polytetrafluoroethylene, silicone resins, and these resins into which titanium oxide, tin oxide, potassium titanate, and other inorganic materials have been dispersed may also be added to improve abrasion resistance. The usual coating methods may be employed to form the protective layer. The protective layer is suitably about 0.1-10 μm in thickness. In addition to the above, known materials such as a-C and a-SiC formed by vacuum thin-film formation may also be employed as protective layers.

[0036] An intermediate layer may also be provided between the photosensitive layer and the protective layer in the present invention. A binder resin is generally employed as the chief component of the intermediate layer. Examples of such resins are polyamide, alcohol-soluble nylon, water-soluble polyvinyl butyral, polyvinyl butyral, and polyvinyl alcohol. The intermediate layer may be formed by the usual coating methods, as set forth above. The thickness of the intermediate layer is suitably about 0.05-2 μm .

[0037] The electrophotographic process and electrophotographic device of the present invention will be described in detail next using the drawings.

[0038] Fig. 4 is a schematic drawing descriptive of the electrophotographic process and electrophotographic device of the present invention. The examples of modification described below also fall within the scope of the present invention.

[0039] In photoreceptor 1 in Fig. 4, a TiOPc photosensitive layer

imparting a specific X-ray diffraction spectrum is provided on an electrically conductive support. Although photoreceptor 1 is shown in the form of a drum, it can also be in the form of a /10 sheet or endless belt. Known means such as corotrons, scorotrons, solid state chargers, and charged rollers are employed for charge charger 3, pretransfer charger 7, transfer charger 10, separation charger 11, and precleaning charger 13.

[0040] A common charger such as those described above may be employed in the transfer means. As shown in the figure, the transfer charger and the separation charger may be effectively combined into one.

[0041] Any light-emitting compound may be employed as the light source of image exposure element 5, discharge lamp 2, and the like, including fluorescent lamps, tungsten lamps, halogen lamps, mercury lamps, sodium lamps, light-emitting diodes (LEDs), semiconductor lasers (LDs), and electroluminescents (EL). To radiate only light of a desired wavelength, various filters may be employed, such as sharp cut filters, band-pass filters, near infrared cutting filters, dichroic filters, interference filters, and conversion filters for color temperature.

[0042] In addition to being irradiated during the step shown in Fig. 4, the photoreceptor is also irradiated with light by providing steps such as a transfer step, a discharge step, a cleaning step, or a preexposure step which employ light irradiation.

[0043] Toner that has been developed on photoreceptor 1 by

developing unit 6 is transferred to transfer paper 9, but not completely; some residual toner remains on photoreceptor 1. Such toner is removed from the photoreceptor by a fur brush 14 and a blade 15. Cleaning is sometimes performed by just a cleaning brush; a known cleaning brush may be employed, such as a fur brush or a mag[netic] fur brush.

[0044] When a positive (negative) charge is applied to the electrophotographic photoreceptor to expose an image, a positive (negative) latent electrostatic image forms on the surface of the photoreceptor. When this is developed with negative (positive) polarity toner (charge detecting micrograins), a positive image is obtained, and when developed with positive (negative) polarity toner, a negative image is obtained. Known methods of development are applied and known methods of discharge are employed.

[0045] Fig. 5 shows another example of the electrophotographic process of the present invention. Photoreceptor 1 comprises a photosensitive layer of TiOPc imparting a specific X-ray diffraction spectrum. Repeat driving by drive rollers 22a and 22b, charging by charger 3, exposure to an image by light source 24, developing (not shown), image transfer by charger 10, precleaning exposure by light source 26, cleaning by brush 15, and discharging by light source 28 are performed. Fig. 6 shows the irradiation of light during precleaning exposure of photoreceptor 21 (which comprises a transparent support) from the support side.

[0046] The above-described electrophotographic process is an example of an implementation mode of the present invention; other implementation modes are of course possible. For example, although precleaning exposure is conducted from the support side in Fig. 5, this can also be conducted from the photosensitive layer side. Further, image exposure and discharging irradiation can also be conducted from the support side.

[0047] Although a light irradiation step is shown for image exposure, precleaning exposure, and discharge exposure, light irradiation can also be conducted during pretransfer exposure, exposure prior to image exposure, and by providing other known light exposure steps.

[0048] An image forming means such as that set forth above can be secured and incorporated into copiers, facsimiles, and printers, or loaded into these devices in the form of a process cartridge. A process cartridge is a single device (part) with a built-in photoreceptor as well as a charging means, exposure means, developing means, transfer means, cleaning means, and discharging means. Process cartridges take numerous forms. Photoreceptor 1 has a TiOPc photosensitive layer imparting a specific X-ray diffraction spectrum on an electrically conductive support.

[0049]

[Embodiments] Embodiments of the present invention are described below; however, the present invention is not limited by these embodiments. All parts are weight parts. A specific example of the synthesis of the titanyl phthalocyanine pigment employed in

the embodiments will be described first.

(Synthesis Example) 52.5 parts of phthalodinitrile and 400 parts of 1-chloronaphthalene were stirred and mixed, and 19 parts of titanium tetrachloride were added dropwise under a nitrogen gas flow. Following completion of the dropwise addition, the mixture was gradually heated to 200°C, and while maintaining the reaction temperature between 190-210°C, reacted for 5 hr with stirring. With the end of the reaction, the mixture was left standing until it reached 130°C, at which time it was filtered while hot. The powder was washed with 1-chloronaphthalene until it turned blue, and then washed several times with methanol. It was then further washed several times with 80°C warm water and then dried, yielding 42.2 parts of coarse titanyl phthalocyanine pigment. Six parts of the coarse titanyl phthalocyanine obtained that had been washed with warm water were stirred at 3-5°C in 100 g of 96 percent sulfuric acid, dissolved, and filtered. The sulfuric acid solution obtained was added dropwise to 3.5 liters of ice water while stirring, the precipitating crystals were filtered out, and the cleaned solution was repeatedly washed with water until it became neutral, yielding a wet cake of titanyl phthalocyanine pigment. To this wet cake were added 150 parts of 1,2-dichloroethane, the mixture was stirred for 2 hr at room temperature, 250 parts of methanol were added, and the mixture was stirred and filtered. The mixture was then washed with methanol and dried, yielding 4.9 parts of titanyl phthalocyanine pigment.

[0050] The X-ray diffraction spectrum of the titanyl phthalocyanine pigment obtained was measured under the following conditions.

/11

[0052] Embodiment 1

Above-described titanyl phthalocyanine powder 3 parts

(4 molar percent degree of acetylation,

(Weight average molecular weight 105,000)

[0053] Embodiment 2

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 2 parts

(5.5 molar percent degree of acetylation,
substituent R was propyl group alone)

(Weight average molecular weight 110,000)

Methyl ethyl ketone 160 parts

[0054] Comparative Example 1

A dispersion of the composition given below was prepared by ball
milling (as Dispersion 3).

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 2 parts

(2.5 molar percent degree of acetylation,
substituent R was propyl group alone)

(Weight average molecular weight 107,000)

Methyl ethyl ketone 160 parts

[0055] Comparative Example 2

A dispersion of the composition given below was prepared by ball
milling (as Dispersion 4).

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 2 parts

(2 molar percent degree of acetylation,
substituent R was propyl groups and methyl
groups in molar ratio of 2 to 1)

(Weight average molecular weight 103,000)

Methyl ethyl ketone 160 parts

[0056] Embodiment 3

A dispersion of the composition given below was prepared by ball milling (as Dispersion 5).

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 1 part

(4 molar percent degree of acetylation,
substituent R was propyl group alone)

(Weight average molecular weight 105,000)

n-Butyl acetate 110 parts

[0057] Embodiment 4

A dispersion of the composition given below was prepared by ball milling (as Dispersion 6).

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 1 part

(4 molar percent degree of acetylation,
substituent R was propyl group alone)

(Weight average molecular weight 150,000)

n-Butyl acetate 110 parts

[0058] Embodiment 5

A dispersion of the composition given below was prepared by ball milling (as Dispersion 7).

Above-described titanyl phthalocyanine powder 3 parts

Polyvinyl acetal 1 part

(4 molar percent degree of acetylation, /12
substituent R was propyl group alone)

(Weight average molecular weight 80,000)

n-Butyl acetate 110 parts

[0059] Embodiment 6

A dispersion of the composition given below was prepared by ball milling (as Dispersion 8).

Above-described titanyl phthalocyanine powder	5 parts
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Polyvinyl acetal	2 parts
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(4 molar percent degree of acetylation,

substituent R was propyl group alone)

(Weight average molecular weight 105,000)

Tetrahydrofuran	170 parts
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Ion-exchange water	5 parts
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[0060] Embodiment 7

A dispersion of the composition given below was prepared by ball milling (as Dispersion 9).

Above-described titanyl phthalocyanine powder	5 parts
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Polyvinyl acetal	2 parts
------------------	---------

(4 molar percent degree of acetylation,

substituent R was propyl group alone)

(Weight average molecular weight 150,000)

Tetrahydrofuran	170 parts
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Ion-exchange water	5 parts
--------------------	---------

[0061] Embodiment 8

A dispersion of the composition given below was prepared by ball milling (as Dispersion 10).

Above-described titanyl phthalocyanine powder	5 parts
---	---------

Polyvinyl acetal	2 parts
------------------	---------

(4 molar percent degree of acetylation,

substituent R was propyl group alone)

(Weight average molecular weight 80,000)

Tetrahydrofuran 170 parts

Ion-exchange water 5 parts

[0062] The conditions (dispersion method and dispersion conditions) used to manufacture the dispersions of above-described Embodiments 1-8 and Comparative Examples 1-2 were identical. The mean grain diameter of dispersions 1-10 manufactured in this manner was measured with a CAPA500 from Horiba Seisakujo K.K. The results are given in Table 1. Further, the dispersions were stored in a stationary manner for one month at room temperature and the appearance of the dispersions was observed. Those results are also given in Table 1.

[Table 1]

	Mean Grain Diameter (μm)	Condition of Dispersion at One Month
Dispersion 1	0.31	Good
Dispersion 2	0.28	Good
Dispersion 3	0.66	Substantial grain precipitation
Dispersion 4	0.79	Substantial grain precipitation
Dispersion 5	0.42	Good
Dispersion 6	0.43	Good
Dispersion 7	0.39	Substantial grain precipitation (no temperature problem)
Dispersion 8	0.48	Good
Dispersion 9	0.50	Good
Dispersion 10	0.46	Substantial grain precipitation (no temperature problem)

[0063] The table reveals that Dispersions 1, 2, 5, 6, 8, 9, and

10 had small grain diameters and remained stable during storage.

[0064] Embodiments 9-10 and Comparative Examples 3-4

The undercoating layer coating solution, charge-generating layer coating solution, and charge-transporting layer coating solution of the compositions given below were sequentially applied on an electrocast nickel belt and dried to manufacture a multilayered photoreceptor.

(Undercoating Layer Coating Solution)

Titanium dioxide powder	15 parts
Polyvinyl butyral	6 parts
2-Butanone	150 parts <u>/13</u>

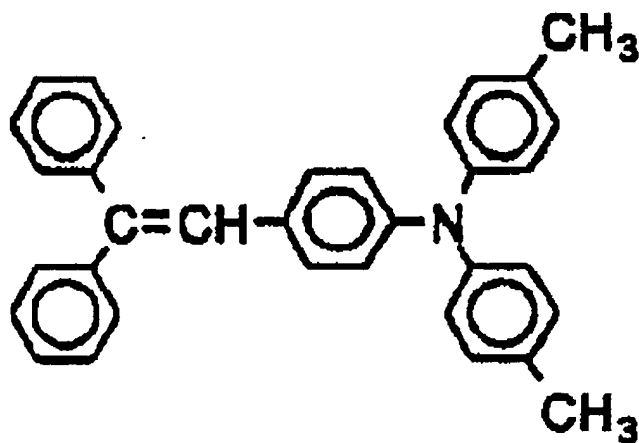
(Charge-Generating Layer Coating Solution)

Each of previously described Dispersions 1-4 was employed.

(Charge-Transporting Layer Coating Solution)

Polycarbonate	10 parts
Charge-transporting substance having structure given by formula below:	8 parts

[Chem. 16]



Methylene chloride

80 parts

[0065] The electrophotographic photoreceptors obtained in this manner were employed in the electrophotographic process shown in Fig. 6 (except that there was no cleaning preexposure). A 780 m semiconductor laser (writing images by means of a polygonal mirror) was employed as the light source for image exposure, and a probe functioning as a surface potentiometer was inserted to permit measurement of the surface potential of the photoreceptor immediately preceding development. Five thousand sheet were continuously printed and the surface potential of exposed portions and non-exposed portions was measured initially and after 5,000 sheets. The results are given in Table 2.

[Table 2]

		Dispersion Employed		Surface Potential (Initial)		Surface Potential (After 5,000 sheets)	
				Non- exposed Portions	Exposed Portions	Non- exposed Portions	Exposed Portions
Embodiment 9	Dispersion 1			-863	-110	-844	-103
Embodiment 10	Dispersion 2			-858	-108	-843	-105
Comp. Ex. 3	Dispersion 3			-831	-106	-652	-96
Comp. Ex. 4	Dispersion 4			-822	-98	-550	-82

[0066] Table 2 shows that even after repeated use, the electrophotographic photoreceptors of Embodiments 9 and 10 maintained stable surface potentials.

[0067] Embodiments 11-13 and Comparative Examples 5 and 6
The surface of an aluminum cylinder was anodized and then treated

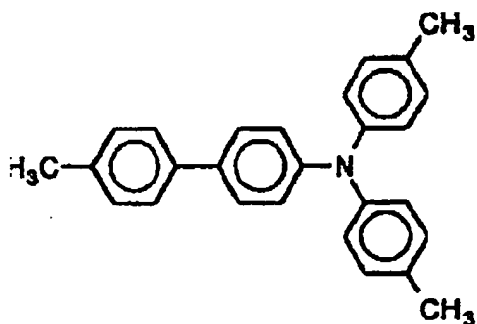
to seal any holes. Thereover, the charge-generating layer coating solution and charge-transporting layer coating solution described below were sequentially coated and dried to form a 0.2 μm charge-generating layer and a 20 μm charge-transporting layer. The electrophotographic photoreceptor of the present invention was then manufactured.

(Charge-Generating Layer Coating Solution) Above-described Dispersions 3-7 were employed.

(Charge-transporting Layer Coating Solution)

Charge-transporting substance with structure below: 7 parts

[Chem. 17]



Polycarbonate 10 parts

Methylene chloride 80 parts

[0068] Embodiments 14-16 and Comparative Examples 7 and 8

The dispersions employed in Embodiments 11-13 and Comparative Examples 5 and 6 were stored in a stationary manner for one month

in the dark at room temperature, after which photoreceptors were manufactured in the same manner as in Embodiments 11-13 and Comparative Examples 5 and 6.

[0069] The electrophotographic photoreceptors thus obtained were mounted in the process cartridges for electrophotography shown in Fig. 7 and loaded in image forming machines. However, a 780 m semiconductor laser (writing images with a polygonal mirror) was employed as the image exposure light source. Three thousand /14 sheets were continuously printed and the image of the first and 3,000th sheet were evaluated. The results are given in Table 3.

[Table 3]

	Dispersion Employed	Initial Image	Image after 3,000 Sheets
Embodiment 11	Dispersion 5	Good	Good
Embodiment 12	Dispersion 6	Good	Good
Embodiment 13	Dispersion 7	Good	Good
Comp. Example 5	Dispersion 3	Good	Background sullied
Comp. Example 6	Dispersion 4	Good	Background sullied
Embodiment 14	Disp. 5 (after storage)	Good	Good
Embodiment 15	Disp. 6 (after storage)	Good	Good
Embodiment 16	Disp. 7 (after storage)	Good	Good
Comp. Example 7	Disp. 3 (after storage)	Background sullied	Background sullied
Comp. Example 8	Disp. 4 (after storage)	Background sullied	Background sullied

[0070] Table 3 shows that when Dispersions 5-7 were employed (the photoreceptors of Embodiments 11-13 and 14-16), good images were obtained even after repeated use and storage of the dispersions.

[0071] Embodiment 17

With the exception that the electrocast nickel belt serving

as the support in Embodiment 9 was replaced with an aluminum cylinder, a photoreceptor was manufactured in precisely the same manner as in Embodiment 9.

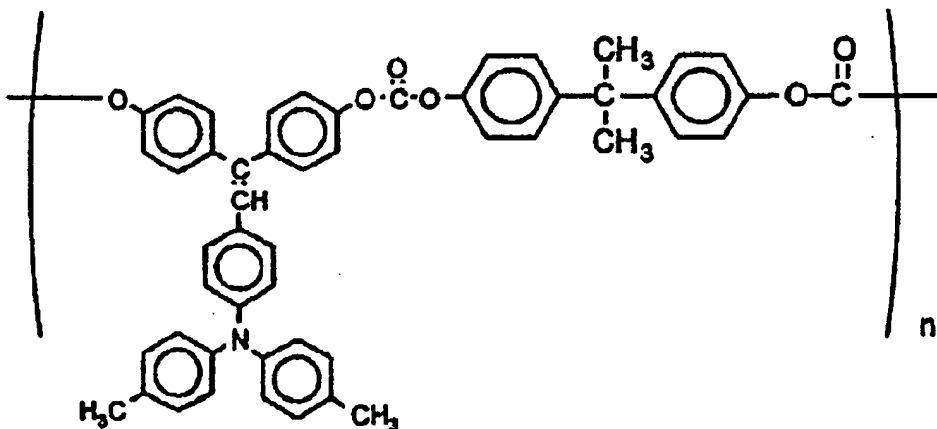
[0072] Embodiment 18

With the exception that the charge-transporting layer coating solution of Embodiment 17 was changed to the following composition, a photoreceptor was manufactured in precisely the same manner as in Embodiment 17.

(Charge-Transporting Layer Coating Solution)

Polymeric charge-transporting substance of structure given below: 10 parts

[Chem. 18]



Methylene chloride

100 parts

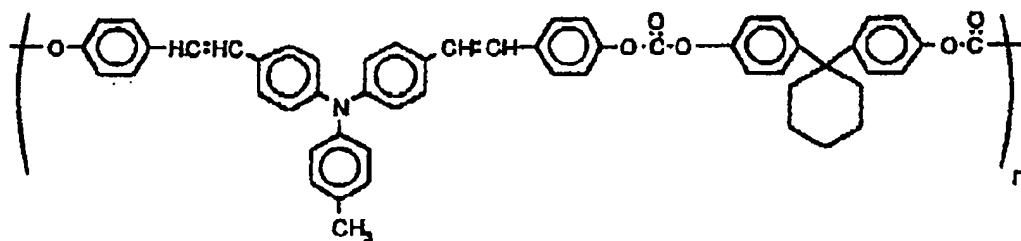
[0073] Embodiment 19

With the exception that the charge-transporting layer coating solution of Embodiment 17 was changed to the following composition, a photoreceptor was manufactured in precisely the same manner as in Embodiment 17.

(Charge-Transporting Layer Coating Solution)

Polymeric charge-transporting substance of structure
given below: 10 parts

[Chem. 19]



Methylene chloride 100 parts

[0074] Each of the electrophotographic photoreceptors of Embodiments 17-19 was employed in the electrophotographic process shown in Fig. 5 (except that a 780 nm light-emitting LD was employed as the light source for image exposure), 10,000 sheets were continuously printed, and the image of the first sheet and the 10,000th sheet were evaluated. Changes (amount of reduction) in the film thickness of the charge-transporting layer were also measured. The results are given in Table 4.

[Table 4]

/15

	Image (Initial)	Image (10,000 th)	Amount of film thickness reduction (microns)
Embodiment 11	Good	Slight black veins (but not to the extent of being problematic)	3.1
Embodiment 12	Good	Good	1.4
Embodiment 13	Good	Good	1.6

[0075] Table 4 shows that the electrophotographic photoreceptors of Embodiments 18-19 had particularly good abrasion resistance.

[0076]

[Effect of the Invention] Based on the present invention, the use of titanyl phthalocyanine imparting a specific X-ray diffraction spectrum and the use of a specific binder resin provide a stable electrophotographic photoreceptor in which high sensitivity is not lost, chargeability does not decrease, and residual potential does not increase even with repeated use. Further, a dispersion is provided that is capable of stably retaining the above-stated characteristics even with extended storage. Still further, an electrophotographic photoreceptor is provided that has improved abrasion resistance while retaining the above-stated characteristics. Still further, a stable electrophotographic process is provided in which high sensitivity is not lost, chargeability does not decrease, and residual potential does not increase even with repeated use. Further, a stable electrophotographic device and process cartridge for an electrophotographic device are provided in which high sensitivity

is not lost, chargeability does not decrease, and residual potential does not increase.

[Brief Description of the Figures]

[Fig. 1] A model sectional view of the electrophotographic photoreceptor employed in the present invention.

[Fig. 2] A model sectional view of another electrophotographic photoreceptor employed in the present invention.

[Fig. 3] A model sectional view of yet another electrophotographic photoreceptor employed in the present invention.

[Fig. 4] A schematic diagram descriptive of the electrophotographic process and electrophotographic device of the present invention.

[Fig. 5] A schematic diagram descriptive of the electrophotographic process and electrophotographic device of the present invention.

[Fig. 6] A schematic diagram descriptive of a representative electrophotographic device of the present invention.

[Fig. 7] An X-ray diffraction spectrum of the titanyl phthalocyanine pigment obtained in the Synthesis Example of the present invention.

[Fig. 5]

[(3) Charge charger (24) [Illegible] light source (1)
Photoreceptor (22a) Drive roller (26) Cleaning preexposure (22b)
Drive roller (28) Discharge light source (15) Cleaning brush (10)
Transfer charger]

[Fig. 6]

[(3) Charge charger (19) Image exposure element (15) Cleaning brush (1) Photoreceptor (20) Developing roller]

[Fig. 4]

[(5) Image exposure element (4) Eraser (3) Charge charger (2) Discharge lamp (15) Cleaning brush (14) Fur brush (13) Precleaning charger (12) Separating [illegible] (11) Separating charger (10) Transfer charger (9) Transfer paper (8) Resist roller (7) Pretransfer charger (6) Developing unit]

[Fig. 7]

[(1) Intensity (2) Bragg angle (2θ)]

【表4】

	画像（初期）	画像（1万枚目）	減衰減少量 （ミクロン）
実施例11	良好	ごくわずかに黒ずみ （ただし、問題になるほどではない）	3.1
実施例12	良好	良好	1.4
実施例13	良好	良好	1.6

【0075】表4から実施例18～19の電子写真感光体 10*。
体は特に優れた耐摩耗性を示していることがわかる。

【0076】

【発明の効果】本発明によれば、特定のX線回折スペクトルを与えるチタニルフタロシアニンと特定のバインダー樹脂を用いることによって、これを使用した感光体において高感度を失うことなく繰り返し使用によっても帯電性の低下と残留電位の上昇を生じない安定な電子写真感光体が提供される、また、長期の保存によっても上述の安定した特性を維持できる分散液が提供される。また、前記特性を維持したまま、耐摩耗性を向上した電子写真感光体が提供される。また、高感度を失うことなく繰り返し使用によっても帯電性の低下と残留電位の上昇を生じない安定な電子写真装置および電子写真装置用プロセスカートリッジが提供され *

【図面の簡単な説明】

【図1】本発明で用いられる電子写真感光体の模式断面図

【図2】本発明で用いられる別の電子写真感光体の模式断面図

【図3】本発明で用いられる更に別の電子写真感光体の模式断面図

【図4】本発明の電子写真プロセスおよび電子写真装置を説明するための概略図

【図5】本発明の電子写真プロセスおよび電子写真装置を説明するための概略図

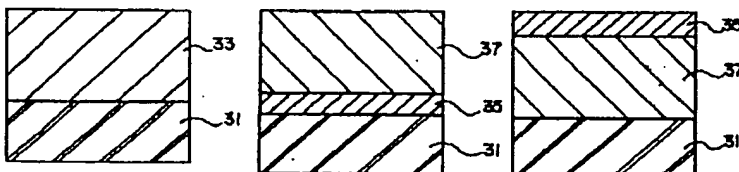
【図6】本発明の代表的な電子写真装置を説明するための概略図

【図7】本発明の合成例により得られるチタニルフタロシアニン顔料のX線回折スペクトル

【図1】

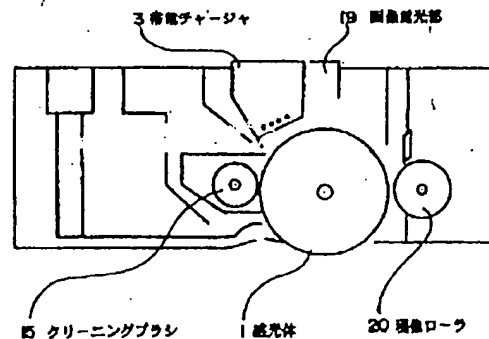
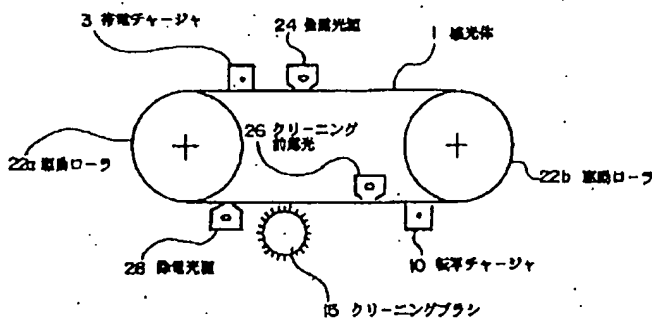
【図2】

【図3】

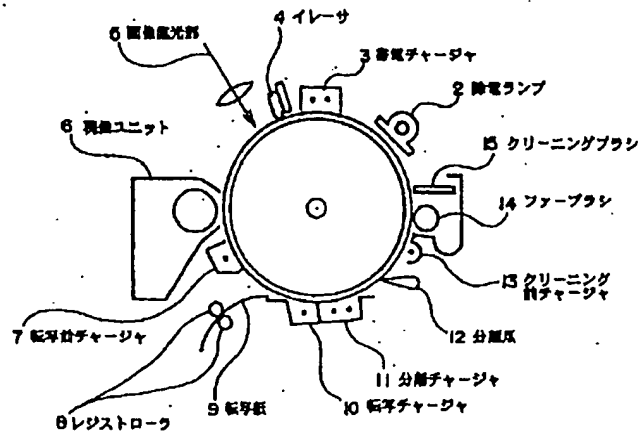


【図5】

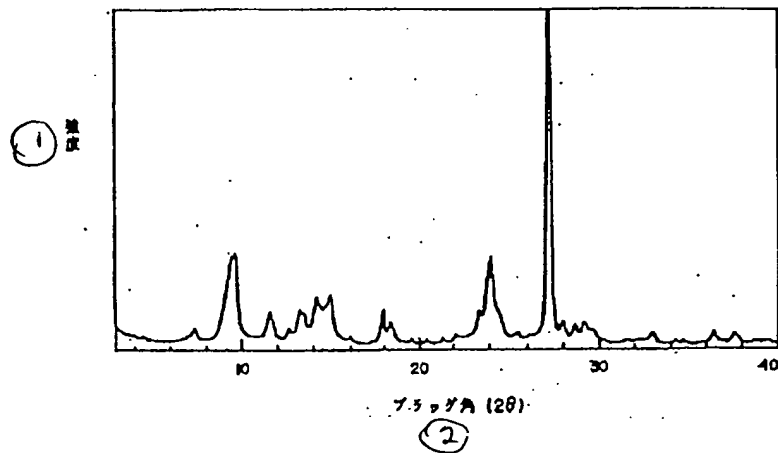
【図6】



【図4】



【図7】



フロントページの続き

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